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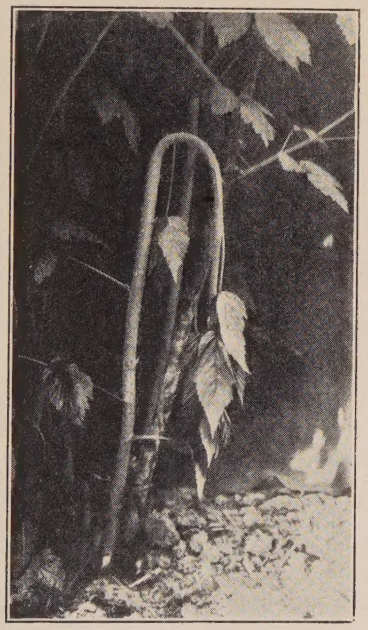
Oregon Agricultural College

Experiment Station

Insect Pests and Diseases of Bramble Fruits

By A. L. LOVETT and H. P. BARSS



Raspberry cane-maggot injury, showing young cane in spring with characteristic "limber-neck" droop.

CORVALLIS, OREGON

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Insect Pests and Diseases of Bramble Fruits

By A. L. LOVETT and H. P. BARSS

BRAMBLE FRUIT INSECTS

By A. L. LOVETT

The insect pests of the cane fruits attack all members of the bramble group. The common names for most of these insects have sprung from the fact that the particular insect was first studied in connection with a certain fruit, or that a certain fruit is of more commercial importance than others. The raspberry cane-maggot could just as well be called the loganberry cane-maggot or the blackberry cane-maggot. Since any of these insects may be found doing serious injury on any bramble fruit, the particular name does not signify that the ravages are limited to the single fruit.

THE LOGANBERRY CROWN-BORER[1]

The crown-borer is one of the most common and seriously injurious insect pests of cane fruits in Oregon. It attacks all types of cane fruits and is sometimes termed the blackberry crown-borer or the raspberry root-borer.

Description. Plants or canes appear sickly or dying. An examination of the interior of the crown or cane reveals large tunnels in which the borer worms are resting.

The grub or borer, when full grown, is slightly more than an inch in length, whitish in color, with a brown head. The body is pinched in or constricted below; there are three pairs of short legs just back of the head.

The adult is a showy, clear-winged, wasp-like, day-flying moth. The body is fuzzy, of a yellowish tinge, decorated with rings of black.

Life-history. The insect passes two seasons as a borer in the crown and root of the plant. The adult moths are active in the field during August and September. Eggs are glued to the margin of the under surface of the leaves. They are hard-shelled, circular and flattened, brownish in color, looking not unlike miniature cookies. The egg stage is about one month, the majority of young grubs hatching in late September and October.

The newly-hatched grubs crawl down the canes to the base or crown of the plant, working their way just below the surface of the soil. They gnaw their way in just under the bark of the crown. Here they form a little pocket or cell, which appears from the outside as a slightly-raised corky blister on the bark. In this little cell they rest during the winter as miniature grubs, less than one-twentieth inch long.

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[1] *Bembecia marginata* Harris.

The grubs or borers become active in the spring, tunneling about through the crown. They generally tend to work upward, increasing in size fairly rapidly. In early summer, as a one-third grown borer, they reach the base of one of the new season's canes and proceed to tunnel up the pith of this cane. The distance they will tunnel varies, averaging probably four inches. In some cases they do not leave the crown, simply feeding for a time at the base of the cane.

In midsummer the half-grown borer, tunneling in the cane, works outward to just beneath the bark, and proceeds to girdle the cane. Following this girdling the infested canes, varying in length from 18 inches to 8 feet, wilt and die.

In late summer the grub, now one year old, works its way back down into the crown and root. Here the second winter is passed. Probably there is more or less activity and feeding this second winter. Tunneling and feeding continue the second spring. In June the borer, now full-grown, works its way upward to the surface of the crown. It seeks out and enters an old stub and in preparation for emergence as an adult changes over to a chrysalis. The chrysalis stage is about two to four weeks. Again during August and September the borers appear as adult moths in the field.

This completes the two-year life cycle. There are two broods apparently, so that we have a brood of worms developing each year.

Injury. In extreme cases of heavy infestation and more commonly in the older plantings the infested plants are actually killed out by the borers. More frequently the crown is weakened and sickly. The foliage and cane show lack of vigor and the berries are under-sized and scanty.

During late summer and early fall the girdled canes are found lying on the ground wilted and dying. Generally one may find little heaps of fresh borings on the surface of the crown. The infested canes are rather easily severed at the girdle, revealing the white borer grub within. Raspberries and loganberries are the favorite hosts. Blackberries are least attacked or at any rate suffer less from the borers. In the case of a particularly vigorous blackberry cane it is not unusual for it to overcome the effect of the borers and continue to grow.

Control

No spray or insecticide yet discovered has proved effective in control. Taking advantage of the borers' habit of twice appearing above ground during the season, fairly satisfactory results are obtained through hand methods in control. These consist in the removal of the wilted canes and the battering down of the old stubs.

Removal of Infested Canes. Go over the field carefully in the summer or early fall, suiting the treatment as far as possible to the regular training-up date and dates for cutting out old canes. Look carefully for any girdled or wilted canes or evidence of fresh borings. Where infested canes are discovered, grasp firmly, and with a twist and a pull you can sever the cane at the girdle. Often the borer is revealed in the severed cane. One may carry a short, heavy wire looped over the belt. This may be inserted in the tunnel of the severed stub to get the borers not found in the cane.

Crushing Over Old Stubs. The mature grubs come up in the stubs to transform. During late May and June, armed with a wooden mallet or similar tool for the purpose, go over the field, simply knocking over or battering down the projecting dried-up stubs. This will destroy the mature borers that have come up to form chrysalises. Unless there is some practical objection to the practice it would appear advisable in cutting out the canes to leave the stubs of a fair length, principally to invite the borers to enter and partly to facilitate breaking them over.

THE CANE-MAGGOT[2]

The new young canes of raspberry, loganberry, and blackberry may sometimes be observed in early spring drooping over in a characteristic "limberneck" fashion. If the affected shoots are examined carefully, a bluish ring will be observed at the base of the wilted tip. Upon cutting into the cane, a small whitish maggot is revealed.

Description. The pest responsible is a small maggot which tunnels about in the canes. The adult of this maggot is a fly, about one-half the size of a house-fly, brown in color and with humped back.

Life-history and Habits. The adult flies appear in the field in early April. They deposit small white eggs in grooves or protected places about the tips of the young canes. The egg stage is about four days. Upon hatching, the young maggot tunnels into the pith of the tender young shoots and starts burrowing downward. After feeding and growing to a fair size and having traveled down the interior of the cane a short distance, the maggot tunnels outward to just under the bark and proceeds to girdle the tip of the shoot. After completing the girdle, the maggot eats rather freely of the pith at this point and finally continues its way downward, burrowing its meandering tunnel through the pith.

In June the full-grown maggot has reached a position somewhere near the base of the cane. Here it changes into a brown capsule-like object termed a puparium. It remains as a puparium in the pith of the cane until the following April, to emerge again as an adult fly.

The Injury. The new canes from 8 inches to 3 feet in height are attacked. All the cane fruits serve as hosts, but blackcaps and the purple-cane varieties of raspberries are worst injured, and loganberries may be seriously attacked. The Cuthbert red raspberry and most varieties of blackberries are able, in a high percentage of the cases, to recover from attack.

It is an interesting circumstance that the death of the shoot above the girdle is essential to the successful development of the maggot. Where, as is so frequently true in the Cuthbert and in blackberries, the cane recovers from the girdling, forming an enlargement or gall at that point and continuing to grow, invariably the maggot fails to survive. Apparently the rapid growth of the cane actually crushes the maggot in its tunnel.

Control

It is the exceptional case where the cane-maggots infest all the shoots in a crown. In vigorous plants where there is an excess of new canes, possibly the cane-maggot is of little economic importance. Where the new canes are scanty, however, the attack is injuriously important.

[2] *Phorbia rubivora* Coquillett.

There is no spray for this insect. As soon as the wilted tips are observed they should be cut off some distance below the girdle, so as to be sure to get the maggot, and removed from the field.

TREE CRICKETS

If one were to make an examination of the canes in practically any of the older bramble fruit plantings in the state, one would be almost sure to find the characteristic egg punctures of the tree cricket. See Fig. 1.

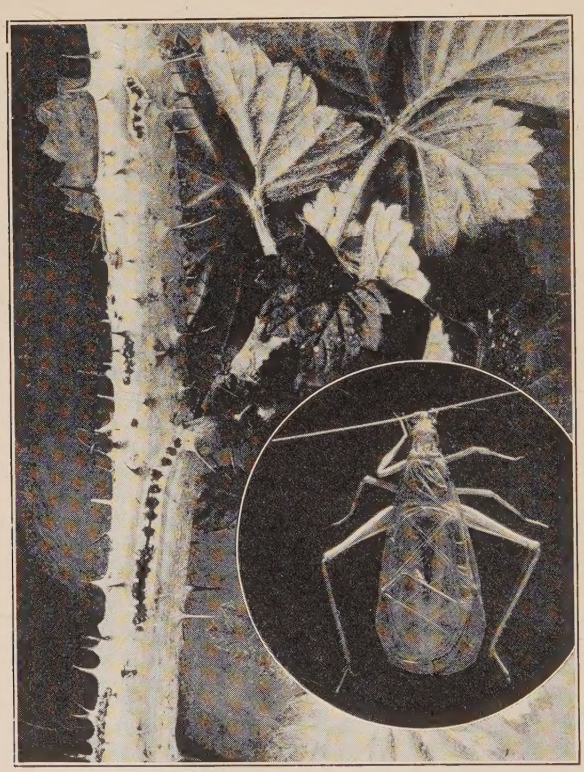

Fig. 1. Tree cricket punctures in cane. An egg is laid in each puncture. Insert shows adult male tree cricket.

Description. If the cane is broken open at the point where these rows of punctures occur, one will find numbers of elongate yellowish eggs imbedded in the pith. The eggs are sometimes mistaken for worms, but an examination shows them as inactive, shiny objects, extending at an angle through the pith. Often the egg punctures extend nearly through the cane. The adult tree crickets are rather fragile, sluggish, greenish-white, cricket-like creatures. They frequent the field during the fall. They are active mostly at night and are rarely observed by

day. In the male cricket the transparent wings are flattened across the back. In the female the wings are folded around the body.

Life-history and Habits. The winter is passed as eggs in the punctured canes; eggs hatch in June, the young long-legged fragile crickets feeding during the summer, partly on foliage and partly on aphids and other small insects. They become full-grown tree crickets during August, and from then on until autumn the females are busy making rows of punctures in the canes and placing their eggs within.

The Injury. The injury is largely a mechanical one due to the punctures made by the female in laying her eggs. These rows of punctures weaken the canes, which, when carrying a load of fruit, often split or break off at the puncture.

Disease fungi may gain entrance through these punctures and cause other disorders of varying magnitude.

Control

No spray or insecticide treatment is known at present. Where the pest is bad, cut out the canes showing rows of egg punctures and burn them. This thinning out can be done any time from fall until late spring.

THE RASPBERRY SAWFLY[3]

The larva of the sawfly is a defoliating worm. The foliage of raspberries and loganberries is especially liable to attack, presenting in midsummer a burned-over, skeletonized appearance.

Description. The larvae occur on the under surface of the leaves. They are of a whitish-green color with branched, spiny hairs covering the body, so that they are distinguished with difficulty from the fuzzy under surface of the leaves on which they feed.

The adult insect is a wasp-like creature, robust of body, shiny black and yellow in color, and about one-fourth inch in length.

Life-history and Habits. The adult sawflies appear in the field during late April and May. The eggs are inserted within the tissue of the leaf, appearing as slightly raised, water-like blisters on the foliage. The egg stage is from a week to fifteen days. The larvae feed on the under surface of the leaves. When young, they eat small circular holes through the foliage. Later the worms eat out the fleshy portions of the leaves, leaving the ribs and veins intact, giving to the foliage a skeletonized appearance. The worms require about fifteen days to develop. When full grown they drop to the soil, tunnel in to a depth of about three inches, spin a parchment-like brownish cocoon, and so remain until the following spring.

Injury. As indicated, the worms defoliate the plants on which they are feeding. Blackberries are seldom materially injured. Raspberries and loganberries may be seriously attacked. Infestation is seldom general. It is usually severe only in limited areas and in an occasional season.

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[3] *Monophadnus rubi* Harris.

A safe rule is to consider no treatment necessary unless the pest has been present the previous season or unless upon examination of foliage in early May the lower leaves exhibit numerous small round holes eaten out. Where worms were present the previous season or where numerous holes are in evidence on the lower leaves, spraying is advisable.

Control

Lead arsenate 2 to 100, applied as an under spray to coat the lower surface of the leaves, will control. The tendency is to delay the application until defoliation is serious. At this late date the advanced stage of development of the fruit makes one hesitate to apply poisoned sprays.

The ideal time to apply spray for sawfly control, according to tests at the Experiment Station, is May 10 to 20. Use an angle nozzle and coat the under surface of the leaves. A second application two weeks later is advisable for aggravated cases.

LEAF HOPPERS

Description. Leaf hoppers occur on the under surface of the leaves as small whitish creatures with sucking mouth parts. In the winged adult stage they fly quickly when approached. Where they occur in numbers their presence is usually recognized because of their habit of rising in small, quickly disappearing clouds ahead of one as he walks in the field. The immature hoppers are greenish, not unlike miniature aphids or plant lice.

Life-history and Habits. The winter is passed as minute blister-like eggs in the bark of the berry canes. The eggs hatch in April and the young hoppers collect on the under surface of the foliage, insert their beaks and suck out the plant juices. They become adults in May; there are several summer broods.

Injury. The injury due to leaf hoppers is seldom noticed unless severe. The foliage first appears speckled, whitish spots appearing on the upper surface of the green leaves. Where heavily attacked, the foliage becomes a sickly-yellow color with blotches of white and dark green here and there.

Control

Fortunately serious injury is not common and usually even speckling of foliage does not become severe until midsummer, after the crop is made. That the hoppers do more damage than they are generally supposed to, is conceded, but with our present imperfect control measures, the tendency is to neglect treatment except in aggravated cases.

Commercial nicotine dust should prove particularly efficacious in control; it is easy and rapid of application and generally satisfactory. We would suggest a dosage of about 20 pounds of 4-percent nicotine dust per acre. Apply during warm days and if possible when there is no wind.

Standard contact sprays of nicotine (1 pint) and soap (4 pounds) to the hundred gallons of water are effective, if applied early in the season against the immature forms. Apply as an under spray. To be effective the spray must actually wet the insects.

MINOR INSECT PESTS

The Fruit Worm. Occasionally reports are received of injury to ripe berries through the invasion of small worms and beetles which eat on or tunnel into the fruit. No opportunity has been afforded to study the pest. From the meager information available it seems possible that we may have the serious raspberry Byturus of the East. The beetles of this insect would appear in late April. They feed for some time on the foliage. Growers who have experienced losses from worms or grubs in the fruit are urged to try spraying a portion of the field during early May with lead arsenate, 2 pounds to 100 gallons, and check with the rest of the field to see if this lessens the infestation.

Spittle Insects. These occur as small brown creatures resting on the bark of the tender terminal shoots in a mass of spittle-like foam. They cause the tips of the infested shoots to blight and die. Small quantities of air-slaked lime cast with force into the mass of spittle will control.

Red Spiders. Occasionally, in seasons of extreme drouth, in the northern and eastern portions of the state, red spiders may become seriously injurious on cane fruits. Dust the foliage with the superfine dusting sulfur.

The Rose Curculio. Serious injury to the flower buds of the blackberry has occurred in limited small fruit sections due to the rose curculio. So far the raspberry and loganberry have escaped, though frequently adjacent to heavily infested blackberry plantings.

The rose curculio is a snout beetle, about ¼ inch long. The body is of a deep red color, the legs and head black, the latter prolonged into a distinct snout or beak.

The flower buds of blackberries just ready to open are attacked. The beetle punctures the buds repeatedly with its beak, the injured buds curling over in a characteristic manner, blighting and dying.

The beetle apparently can not breed in the blackberries but must depend for this purpose on the wild rose. Probably the destruction of the wild rose hedges in the vicinity of small fruit fields where the injury occurs would solve the difficulty.

The Rose Scale is of rather infrequent occurrence as a serious cane fruit pest. The scale occurs on the bark of the cane as a conspicuous, circular, fair-sized scale, white in color with a yellowish, raised center. Dormant sprays of lime-sulfur or oil will control.

The Cane Miner. In almost every field, particularly of raspberries, occasional canes will be observed with winding mines up and down and encircling the canes. These are produced by a minute larva of a very small moth. The mines are apparently confined to the region between the outer and inner growing bark and are of little or no economic importance. No control measures are necessary.

The investigations of our small fruit insects in Oregon are grievously incomplete and more studies are seriously needed. In the meantime reports of outbreaks, accompanied by samples of the pest or injury, are desired by the Oregon Experiment Station.

BRAMBLE FRUIT DISEASES

By H. P. BARSS

Although something is known as to the cause and method of control of several of the common diseases of the brambles or cane fruits in the Northwest, yet there are a number of troubles causing serious losses

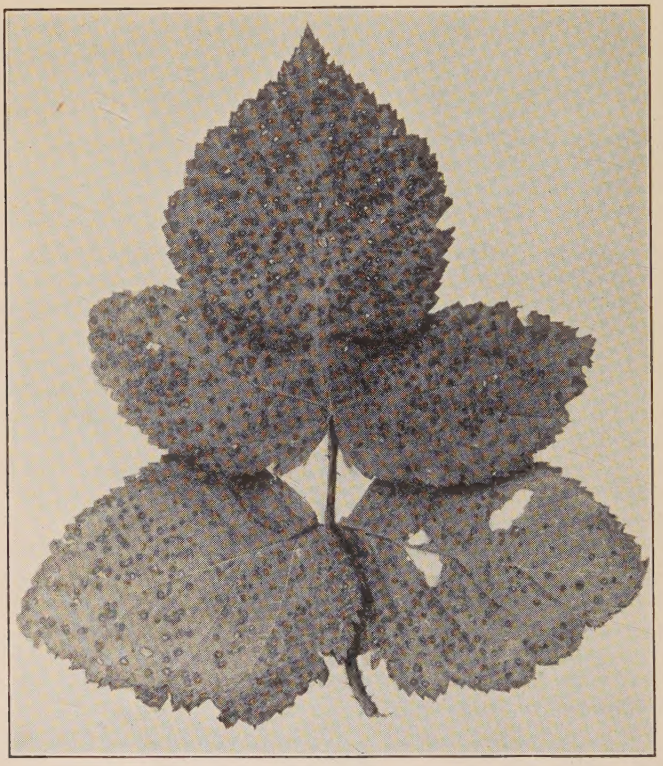

Fig. 2. Anthracnose spots on loganberry leaf. Foliage spotting always occurs when the disease is present. Bordeaux spray is used to control.

which have not been given satisfactory scientific study and about which very little is known. While the information given here must, therefore, be far from complete, it is offered in the hope that some of the diseases may be better recognized and that such control measures as can be practiced may be based on the best information now available to the Experiment Station.

ANTHRACNOSE OF CANE FRUITS

Symptoms. This disease, which is common on loganberries and on some other varieties of brambles, produces on the canes and leaves small purple spots which later become light gray in color in the center with dark purplish margins. When moist weather conditions prevail after blossoming, the fruit may be attacked and individual drupelets become discolored and shriveled, but this effect is not abundant in ordinary seasons unless the disease has previously attacked the stems and foliage severely. The spotting of the older leaves is an invariable accompaniment of the disease. Where no leaf spotting occurs it is safe to assume that anthracnose is absent and that measures designed to control it are needless.

Fig. 3. Anthracnose spotting on loganberry canes. To prevent such attack where the disease is troublesome new canes should be thoroughly sprayed with bordeaux as soon as fruit harvest is over.

Other conditions such as dry weather, lack of soil moisture, the cutting of roots in cultivation, borer attack, etc., frequently cause berries to shrivel, and the grower should not mistake this drying up for anthracnose attack. Other diseases or insects affecting the canes or roots may also cause the berries to dry up.

Cause. The cause of anthracnose is a fungus *(Plectodiscella veneta)* which produces numerous microscopic spores from the spots on canes and leaves. These spores are spread about in various ways and in wet weather cause new infections which develop into fresh anthracnose spots. The fungus lives over winter on the old leaves and affected stems, which produce a crop of spores in the early spring. After the disease once gets a start from this source it can continue with every favorable weather period to spread from spores produced on the new leaves and shoots.

Control

All control for this disease is preventive in nature. The first step is to cut out and get rid of the old canes by burning or deep burying just as soon as the fruit is all picked. This removes a good deal of infective material. The new canes with their leaves should, however, be protected at once by a thorough covering of bordeaux mixture (4-4-50).

In spraying not only should both sides of the leaves be covered but all sides of the canes clear down to the base. If this is done very few

new infections will usually occur when the fall rains come on, and the new growth of the season will go through the winter relatively clean.

Where the trouble has become very severe, enough disease will often be carried over winter in spite of spraying after harvest to make spring sprays advisable. Spray the new growth first as the earliest new leaves are approaching full size. Use bordeaux 4-4-50. If necessary repeat just before bloom. If these applications do not adequately suppress the disease, the fruit may be further protected by using a colorless copper spray such as Burgundy mixture (2-3-100) within a week or two after the petals fall, but this will rarely be required under Oregon conditions.

CROWN GALL (ROOT AND CANE GALL)

Symptoms. This disease may attack all kinds of bramble fruits as well as tree fruits, etc. It is gradually becoming more common in cane fruit plantings and should be strictly guarded against. Irregular-shaped tumors or galls are formed on the parts below ground. Where these occur at the crown they tend to strangle the plant, resulting in a stunted and unproductive condition. Sometimes the disease extends up into the canes, the gall tissue breaking out in long splits along the stems.

Cause. The cause is a species of bacterium *(Bacterium tumefaciens)*. These bacteria are able to persist in the soil about affected plants. They enter the plant through wounds and abrasions and stimulate the tissues to an excessive and abnormal cancerous growth. The disease is spread for the most part by cultivation where cultivation tools contaminated by contact with galls or germ-infested soil come in contact with the roots or crowns of healthy plants.

Control

The disease cannot be cured. Diseased plants should be removed completely as soon as discovered and carried away to be burned. As a further precaution the contaminated soil about the plant may be removed and replaced by clean soil. Very great care should be observed to avoid injury to the crowns of healthy plants in cultivation.

The disease may readily be introduced into a new planting by means of tips obtained from fields harboring the disease even though the young plants may show no signs of galls when set out. Tips should be secured, therefore, only from healthy yards and planted in soil free from the disease.

RASPBERRY RUST

Red raspberries frequently develop a rust disease of the foliage particularly noticeable in seasons when spring rains continue late. The leaves are dotted over with orange spots composed of the rust spores which are readily dusted off on the clothing of the pickers. As far as can be learned this disease does only minor damage to the plants, and since no practical method of control is known it may be given little consideration by the grower. The cause is a parasitic rust fungus belonging to the genus *Phragmidium*.

ORANGE RUST

This disease of blackberries and raspberries caused by the rust fungus, *Kunkelia nitens*, is met with only occasionally. The parasite develops internally within the plant and all the new growth appearing in the spring on infected canes is abnormal and the foliage is apt to be almost completely covered beneath with a solid growth of powdery orange rust

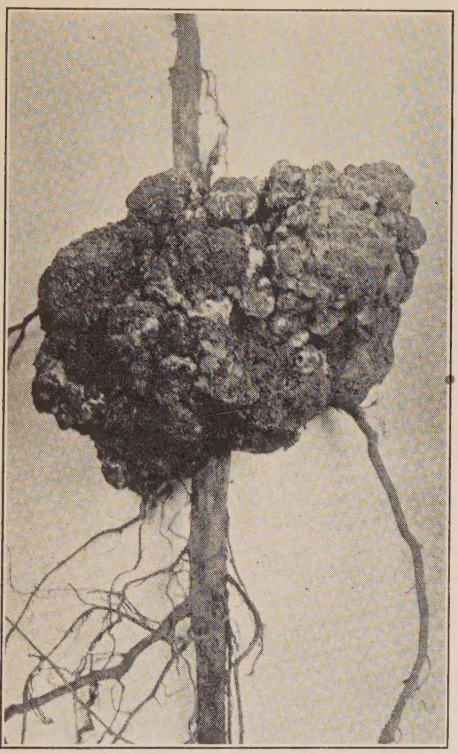

Fig. 4. Above, crown gall (bacterial cancer) choking a young loganberry plant. Tips grown in a yard where the disease is present may transmit the disease.

Fig. 5. At right, crown gall breaking out through a blackberry cane. Plants found infected either above or below ground should be removed root and branch and burned at once.

spores which burst out through the blistered leaf surface. The disease does not spread very actively under Oregon conditions so far as observed. The only known method of control consists in the destruction of the affected plants as soon as signs of the disease appear.

TROUBLES OF NON-PARASITIC OR UNKNOWN ORIGIN

There are serious losses caused in many yards annually by conditions which result in the dying out of hills, dying back of the canes, death of individual buds or spurs and an unhealthy condition at the base of the canes accompanied often by a grayish color and sloughing or splitting of the bark. These troubles need careful investigation to determine the various causes involved and to devise preventive measures, but some of the suspected causes may be mentioned here.

Winter Injury. It is believed that immaturity of the canes due to imperfect hardening of the tissues at the end of the growing season often renders the plants susceptible to winter injury. This may doubtless be controlled, at least to some extent, by cultural practices which bring about normal maturing and prevent late growth or renewed growth in the fall. Raspberries appear to be especially susceptible to this type of trouble. Loganberries also frequently suffer from damage due to low temperatures. This is often more marked when the canes are trellised in the fall, but under Western Oregon conditions it is believed by many that any danger of injury added by having the vines upon the wires through the winter is more than counterbalanced by the danger of injury to the buds which is likely to result from leaving the canes down on the wet ground covered by weeds during the average dormant season.

Bud Blight on Prostrate Loganberry Vines. Damage to the Western Oregon loganberry crop estimated as high as 25 percent has been noted in years characterized by wet and mild winter conditions. Investigations conducted in 1921 by Doctor S. M. Zeller of the Oregon Experiment Station revealed the fact that this loss was due largely to a blighting of buds which occurred only on those portions of the vines lying prostrate on the ground during the winter, particularly where weedy vegetation grew up and covered the canes, maintaining continuously moist conditions about them for long periods of time. It is believed that the buds are probably killed by the attack of some weak fungous parasite. This type of injury appears never to occur on the parts of the canes raised from the ground and is absent when the canes are trained up on the wires in the fall. Many experienced growers believe that with vines properly matured it is the wisest practice to have the vines up off the ground through the winter.

Soil Conditions. Unsatisfactory soil conditions often lead to a loss of vigor, vitality, and productiveness which can only be prevented by the selection of the right type of soil for cane fruit plantings and the maintenance of abundant fertility and organic matter (decaying vegetable matter) in the soil. Exhausted soils, lacking in nitrogen and deficient in moisture-holding capacity cannot maintain healthy and productive growth. Cane fruits are likewise sensitive to wet feet due to poor drainage conditions. Shallow soils are also often the cause of trouble. Mention of the causes in such cases suggests the remedy.

Drouth. Cane fruits are sensitive to excessive drying out of the soil due to prolonged drouth, improper or insufficient cultivation, etc. The bad effects of such conditions not only are felt in the crop of the same

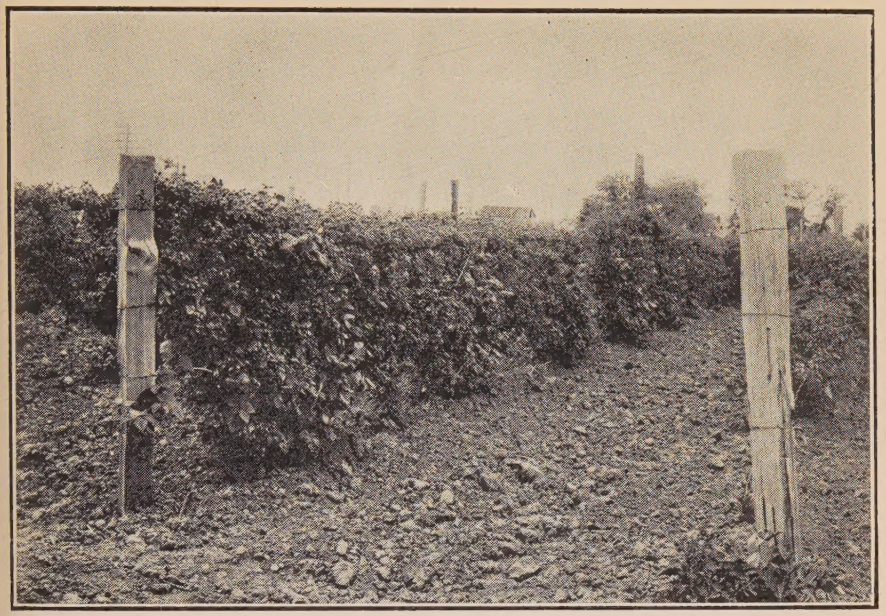

Fig. 6. Trained up in the fall, the loganberry vines in this part of the yard showed no dieback or bud blight the next spring.

Fig. 7. Left down on the ground through the winter, the loganberry vines in a different part of the yard shown in Fig. 6 suffered from severe dieback of the fruiting canes. Vigorous growth of new canes shows that roots are healthy.

season but may show up in decreased vitality the following year. Cultivation must be begun early and kept up carefully. Care must be taken to avoid injury to feeding roots in cultivation, for excessive root pruning after growth has started results in an inevitable check to the plants. Cover crops, though of great value, if left standing too long may result in greater harm than good by withdrawing much soil moisture needed by the vines.

Dying Out of Hills. Much damage has been observed in red raspberry, black cap, and loganberry yards from a disease which causes the eventual death of individual hills. Plants first show a reduced growth and inferior crop. The next year the number of new canes is reduced and their length often cut down. The new foliage generally presents a somewhat unnatural appearance. By the third year the hill is often dead. The cause of this trouble is unknown. It seems to be increasing in extent. It occurs often in the best cared for and most vigorous yards and appears to have no relation to soil or other environmental conditions. It is suspected that the disease may be transmitted in some way from hill to hill, and there is a strong probability that tips propagated from diseased plants may carry the disease. For the protection of the others, it would appear to be the safest procedure to remove hills that show indications of the trouble. Particular care should be taken in establishing new plantings to secure tips from yards known to be free from any traces of the disease.

The Experiment Station is now preparing a circular which is expected to appear shortly under the title "Mosaic and Other Systemic Diseases of Brambles." This circular will describe more in detail and illustrate with photographs the troubles just referred to.

Note: Directions for the preparation of particular spray materials may be secured on application to the Experiment Station.